

6.8 DAIRY OPERATIONS

6.8.1 Introduction

The Department regulates dairy operations that annually house a monthly average of 100 or more lactating cows per day.

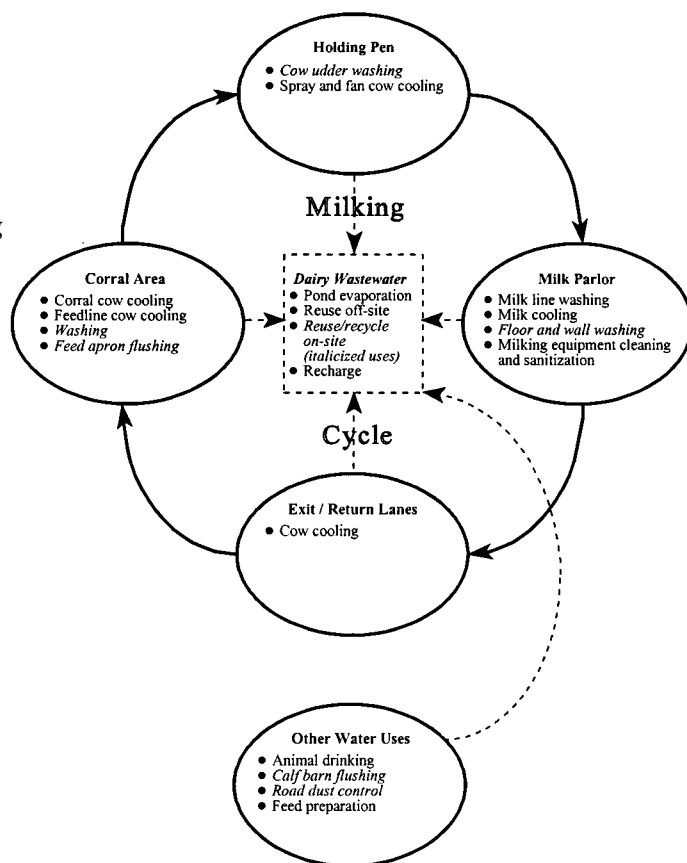
6.8.2 Water Use by Dairy Operations

There are currently nine dairy operations in the Pinal AMA. These facilities hold Type 1 and Type 2 grandfathered rights and groundwater withdrawal permits totaling more than 2,100 acre-feet. Water use by dairies in 1995 was nearly 1,000 acre-feet, or just less than 48 percent of their total annual allotments. Dairy water use has been steadily increasing since 1989, and the Department projects this trend will continue through the year 2025. Dairy operations are a small, but growing industrial water user in the AMA. Many of Arizona's large, established dairies are currently located in the Chandler/Gilbert area of the Phoenix AMA. However, this area is rapidly being urbanized and many of the dairies are relocating. It is anticipated that a number of these dairies will relocate to the Pinal AMA.

Figure 6-2 shows how water is used at a dairy. A significant amount of water is used for the milking cycle. The first step in the milking cycle at most dairies is moving the cows into a holding pen, where the udders are washed before milking. Sprinklers, arranged in a grid pattern on the floor of the pen, are turned on to wash the udders. The cows may be cooled during udder washing to enhance milk production. The animals are then moved to the milking parlor for milking, after which they are returned to the corral area through return lanes. Each time the cycle is completed, the holding pen and parlor areas are cleaned, milk lines are washed, milking equipment is cleaned and sanitized, and manure is removed.

There are a number of dairy management decisions that affect water use. Animal cooling to reduce heat stress and enhance milk production is an increasingly common management practice. Cooling is usually done when temperatures exceed 85 to 90 degrees Fahrenheit and may be done at a number of points in the milking cycle, including the holding pen corral, at the parlor exit, along the fenceline feeding area, or in the corral area. Approximately 95 percent of dairies in the AMAs cool their cows during some portion of the milking cycle. Cooling practices have increased during the past decade and are expected to continue to increase in the future. Whereas at many existing dairies lactating cows are often cooled at only one or two of the possible locations, newly designed dairies incorporate cooling wherever possible.

FIGURE 6-2
WATER USE AT A TYPICAL
DAIRY OPERATION



Italicized items can use reused and/or recycled water.
Not all water uses shown on this chart exist at every dairy

Milking cycle frequency is another management decision that will affect water use. Cows may be milked two, three, or even four times daily. Increasing the number of milking cycles per day will increase water use. Dairy managers evaluate the benefits of milking two or three times per day based upon parlor capacity, milk yield, staffing, and other economic factors. If future market demands require increasing milk pounds of production per cow, milking up to four times a day could become commonplace.

Aside from the milking cycle, water is used for drinking needs, controlling dust, and, at some dairies, feed preparation. Water used for drinking needs varies, depending upon whether the animal present at the facility is a lactating cow (a cow producing milk) or a non-lactating animal (calves, heifers, dry cows, bulls, and steers). A lactating cow drinks an average of 30 gallons of water per day with some seasonal variation. By contrast, a non-lactating animal drinks an average of 15 gallons per day with some seasonal variation.

Whether replacement animals and non-lactating animals are housed on-site or off-site can significantly affect water use. Each dairy keeps lactating and mature dry cows on-site at a ratio that remains relatively constant throughout the year with some variation due to weather and breeding. Another management decision is whether replacement animals, such as calves and heifers, are housed on-site. Typically, if replacement animals are housed on-site, the total number of replacement animals plus mature dry cows equals the number of lactating cows. Some dairy managers prefer to purchase replacement animals as needed or raise the animals in cooler climates until they near calving age. Approximately 40 percent of Arizona dairies raise their replacement animals off-site.

Within the milking cycle, the dairy industry practices that have the most significant water conservation potential are the udder washing process, the practice of water recycling, and, to a lesser extent, cleaning and sanitization. The typical udder washing cycle consists of a one-minute washing, a two-minute break, followed by a three-minute washing. At many dairies, more water is used in the udder washing process during the summer months, though no increase is warranted for sanitation reasons. Summer water use can easily be reduced with little or no additional management or equipment costs. Many dairies have invested in automatic timers to manage the udder wash system. Timers reduce the potential for excessive manual washing, provided the timer is used appropriately. Proper management is the best way to control water waste, and the use of automatic timers can result in significant water savings. Other factors affect the amount of water used for udder washing. Regular and frequent washing of the corral walkway areas reduces the potential for soiled udders and thus reduces wash water needs. Periods of wet weather result in muddy corrals requiring longer udder washing cycles or increased washing of corral walkways and milking areas.

Another important water conservation practice for dairies is recycling of wastewater generated by the dairy. Wastewater may be conveyed to a lagoon where it evaporates, delivered off-site for non-dairy uses (such as irrigating crops), or recycled and reused at the dairy. There are many opportunities for recycling at a dairy. Milk cooling using vacuum pumps produces discharged water that can be captured and used in the udder washing cycle or for certain other washing and cleaning purposes. At some facilities, and depending upon how the recycled water is used initially, this water can be captured a second time and used again. For example, recycled water used for udder washing may be recycled again to wash corral walkways. Recycling offers the dairy manager several benefits including: lower water costs, less wastewater to dispose of, less free-standing water, drier conditions, and cleaner cows. Recycling should be evaluated and implemented wherever feasible in new dairies. Health and sanitary requirements may prohibit the use of recycled water for certain water uses at a dairy.

At many dairies, the amount of water used for cleaning and sanitizing the holding pen, milking parlor, and milk transport lines after each milking increases during the summer months, though no increase may be warranted. Summer water use for this purpose can easily be reduced with little or no additional management or equipment costs.

6.8.3 Program Development and Issues

During the first management period, dairy operations did not have any specific conservation requirements. When the Second Management Plan was developed, the Department conducted a study to identify dairy water use patterns, processes, and associated water use to determine conservation requirements for dairy operations. Several dairies were visited during the study. Experts from the University of Arizona reviewed and supplemented the study and had significant input to the conservation requirements. Conservation requirements for the second management period established a maximum annual water allotment for dairies beginning in 2000. The annual allotment was determined using per animal water use needs for lactating cows and non-lactating animals and could vary depending upon the number of animals at the facility. Upon application, the Department could approve an additional allocation of water for a dairy operation above its annual allotment if the dairy operation demonstrated that milking, sanitary, or cooling needs would require more water.

During the second management period, rapid changes in cooling technologies and the increased diversity in dairy size and design have made it more difficult to expect all dairies to be able to conform to an allotment based conservation requirement. In an effort to have higher milk production efficiency, newer dairies tend to employ more cooling practices and incorporate more methods to recycle or reuse water.

The Department has been informed by the dairy industry that future facilities will have to be larger and utilize these new cooling technologies in order to be economically competitive. These practices are designed to increase the milk yield per lactating cow and will require more water than historical use indicates. The conservation program for the third management period provides dairies the opportunity to choose one of two conservation programs. Dairies may opt to have an allotment-based program identical to the Second Management Plan requirements, or dairies may apply for a program in which the requirements are specified best management practices (BMPs).

6.8.4 Dairy Operations Conservation Program

6.8.4.1 Allotment Based Requirements

The amount of water required by a dairy depends upon the number of cows and non-lactating animals housed at the dairy, herd composition, and dairy management practices. Table 6-2 summarizes daily water needs for each dairy process assuming use of appropriate water conservation technology and practices. The water needs listed are based upon two assumptions: (1) milking is done three times per day per lactating animal, and (2) cooling is done during the milking cycle for at least a portion of the herd.

The assumptions of Table 6-2 are the basis for the maximum annual water allotment for dairy operations. When calculating the annual allotment, lactating cows are allotted 105 gallons per animal per day (GAD) and non-lactating animals are allotted 20 GAD. The allotment is calculated annually and will vary with the average daily number of lactating cows and non-lactating animals present at the dairy each year.

Upon application, the Department may approve an additional allocation of water for a dairy operation above its annual allotments if the dairy operation demonstrates that one or more of the following conditions exist at the dairy:

- Milking is being done more than three times daily.
- Technologies that are designed to achieve industry health and sanitation objectives, such as the recommended pre-milking sanitation method, are being used.
- Animal cooling technologies designed to increase milk production are being used.

TABLE 6-2
WATER NEEDS AT A TYPICAL DAIRY

Operation	Water Use Allocation (gallons per day)	
	Lactating Cow	Non-Lactating Animal
Drinking needs ¹	30	15
Udder washing - based on 72 minutes/day at 8 gallons/minute; 16 cows per milking (two per group). (Varies with number of milkings per day. ¹)	35	0
Barn cleanup and sanitizing. (Varies with number of milkings per day. ¹)	20	0
Animal cooling management option (site-specific)	10	0
Calf barn cleanup	0	5
Milk cooling tower (if present)	5	0
Miscellaneous	5	0
Total	105	20

¹ Assumes three milkings per day.

In consideration of wet weather, the Department has included a three-year averaging provision in the maximum annual water allotment for the third management period. The water use of three consecutive years can be averaged and used to determine compliance with the annual allotment.

6.8.4.2 Best Management Practices Requirements

As an alternative to the annual allotment requirement, a dairy operation may submit an application to the director under the Best Management Practices Program (BMP Program). This program requires implementation of conservation and management practices to maximize efficiency in the following water use categories:

- Delivery of drinking water for dairy animals;
- Udder washing and milk parlor cleaning;
- Corral maintenance and design;
- Cleaning and sanitizing milking equipment;
- Dust control, calf housing cleaning, and feed apron flushing;
- Dairy animal cooling; and
- Feed preparation.

Implementation of all the standard BMPs listed in Appendix 6B will have a specific measurable result. While most of the standard BMPs are applicable to all dairies, the water use activities associated with some of the standard BMPs may not exist at all dairies. If a dairy cannot implement a standard BMP, the dairy may apply to implement a substitute BMP with a specific measurable result that demonstrates a water savings equivalent to the water savings associated with the standard BMP. If a substitute BMP is not possible, the dairy may apply for a waiver of the standard BMP. The director may grant a waiver only for the following standard BMPs: (1) BMP 2.1.2 (Udder Wash System); (2) BMP 2.2.2 (Milking Parlor Floor and Wall Washing); (3) BMP 4.1.1 (Milk Cooling and Vacuum Pump); (4) all of the standard BMPs in Water Use Category No. 5 (Dust Control, Calf Housing Cleaning, and Feed Apron Flushing); (5) all of the

standard BMPs in Water Use Category No. 6 (Dairy Animal Cooling); and (6) all of the standard BMPs in Water Use Category No. 7 (Dairy Animal Feed Preparation).

Five years after a dairy operation is accepted for regulation under the BMP Program, the director will review the dairy's BMPs to determine if they are still appropriate. If the BMPs are no longer appropriate due to an expansion of the dairy or a change in management practices, the director will require a modification to the BMPs.

6.8.5 Future Directions

Although newer dairies tend to use more water for cow cooling than older dairies by employing more cooling technologies and practices, thoughtful design will allow dairies to reuse and recycle more water than they have in the past. The latest "state of the art" dairies even effectively collect or use rainfall. Fourth management period conservation requirements may need to be adjusted to reflect the increased presence of these changes. Any changes to the allotment, however, will need to be based on verifiable data.

6.8.6 Industrial Conservation Requirements and Monitoring and Reporting Requirements for Dairy Operations

6-801. *Definitions*

In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes, unless the context otherwise requires, the following words and phrases used in sections 6-802 through 6-805 of this chapter shall have the following meanings:

1. *“Dairy animal” means a lactating cow or a non-lactating animal present at a dairy operation.*
2. *“Dairy operation” means a facility that houses an average of 100 or more lactating cows per day during a calendar year as calculated in section 6-802.*
3. *“Dairy wastewater” means any water which has been put to a beneficial use at the dairy operation, including water containing dairy animal wastes.*
4. *“Lactating cow” means any cow that is producing milk which is present on-site at a dairy operation and receives water through the dairy operation’s watering system.*
5. *“Non-lactating animal” means a calf, heifer, mature dry cow, bull, or steer that is present on-site at a dairy operation and receives water through the dairy operation’s watering system.*

6-802. *Maximum Annual Water Allotment Conservation Requirements*

A. *Maximum Annual Water Allotment*

Beginning on January 1, 2002 or upon commencement of water use, whichever is later, and continuing thereafter until the first compliance date for any substitute conservation requirement in the Fourth Management Plan, an industrial user shall not withdraw, divert, or receive water for use at a dairy operation during a calendar year in a total amount that exceeds the dairy operation’s maximum annual water allotment for the year as calculated in subsection B below, unless the industrial user applies for and is accepted into the Best Management Practices Program (BMP Program) described below in section 6-804.

B. *Calculation of Maximum Annual Water Allotment*

A dairy operation’s maximum annual water allotment for a calendar year shall be determined as follows:

1. *Calculate the average daily number of lactating cows and non-lactating animals which are present during the calendar year. The average daily number of lactating cows and non-lactating animals present during the calendar year shall be calculated as follows:*
 - a. *Determine the total number of lactating cows and non-lactating animals present at the dairy operation on the last day of each month during the calendar year.*
 - b. *For each category of animal, add together the total number of such animals present at the dairy operation on the last day of each month during the year in question, and*

then divide the result by 12. The quotient is the average daily number of lactating cows and non-lactating animals present during the calendar year.

2. *Calculate the dairy operation's maximum annual water allotment for the calendar year as follows:*

- a. *Multiply the average daily number of lactating cows present during the calendar year by 105 gallons per animal per day (GAD) and then convert to acre-feet per year as follows:*

$$C_L \times \frac{105 \text{ GAD}}{325,851 \text{ g/af}} \times \text{d/yr} = \text{Maximum annual water allotment for lactating cows (acre-feet per year)}$$

Where: C_L = Average daily number of lactating cows
GAD = Gallons per animal per day
g/af = Gallons per acre-foot
d/yr = Days in the year

The result is the dairy operation's maximum annual water allotment for lactating cows for the calendar year.

- b. *Multiply the average daily number of non-lactating animals present during the calendar year by 20 GAD and then convert to acre-feet per year as follows:*

$$A_N \times \frac{20 \text{ GAD}}{325,851 \text{ g/af}} \times \text{d/yr} = \text{Maximum annual water allotment for non-lactating animals (acre-feet per year)}$$

Where: A_N = Average daily number of non-lactating animals
GAD = Gallons per animal per day
g/af = Gallons per acre-foot
d/yr = Days per year

The result is the dairy operation's maximum annual water allotment for non-lactating animals for the calendar year.

- c. *Add the dairy operation's maximum annual water allotment for non-lactating animals for the calendar year as calculated in subparagraph b of this paragraph and the dairy operation's maximum annual water allotment for lactating cows for the calendar year as calculated in subparagraph a of this paragraph. The sum is the maximum annual water allotment for the dairy operation for the calendar year, except as provided in subparagraph d of this paragraph.*
- d. *Upon application, the director may approve an additional allocation of water for the dairy operation consistent with industry health and sanitation objectives if the dairy operation requires more than its maximum annual water allotment because of one or more of the following:*

1. *milking per lactating cow occur more than three times daily,*

2. *technologies are used to achieve industry health and sanitation objectives that require additional water use or,*
3. *technologies are designed and/or implemented for cooling lactating cows and non-lactating animals which increase milk production.*
3. *Nothing in this section shall be construed to authorize a person to use more water from any source than the person is entitled to use pursuant to a groundwater or appropriable water right or permit held by the person. Nor shall this section be construed to authorize a person to use water from any source in a manner that violates Chapter 1 or Chapter 2 of Title 45, Arizona Revised Statutes.*

6-803. Compliance with Maximum Annual Water Allotment

An industrial user who uses water at a dairy operation is in compliance for a calendar year with the dairy operation's maximum annual water allotment if the director determines that either of the following applies:

1. *The volume of water withdrawn, diverted, or received during the calendar year for use at the dairy operation, less the volume of dairy wastewater delivered from the dairy operation to the holder of a grandfathered groundwater right for a beneficial use, is equal to or less than the dairy operation's maximum annual water allotment for the calendar year; or*
2. *The three-year average volume of water withdrawn, diverted, or received for use at the dairy operation during that calendar year and the preceding two calendar years is equal to or less than the dairy operation's three-year average maximum annual water allotment for that calendar year and the preceding two calendar years. In calculating the three-year average volume of water withdrawn, diverted, or received for use at the dairy operation, the volume of dairy wastewater delivered from the dairy operation to the holder of a grandfathered right for a beneficial use shall not be counted.*

6-804. Best Management Practices Program Conservation Requirements

A. Criteria for Approval of Application

An industrial user who uses water at a dairy operation may apply for regulation under the BMP Program by submitting an application on a form provided by the director. The director shall approve a complete and correct application for regulation under the BMP Program if the director determines that the applicant will implement all of the standard BMPs described in Appendix 6B, unless the director approves a substitution of a standard BMP under subsection D of this section or a waiver of a standard BMP under subsection E of this section. If the director approves a substitution of a standard BMP, the director shall approve the application if the director determines that the applicant will implement the substitute BMP or BMPs in addition to any remaining standard BMPs.

B. Exemption from Maximum Annual Water Allotment Conservation Requirements

An industrial user accepted for regulation under the BMP Program is exempt from the maximum annual water allotment conservation requirements set forth in section 6-802 beginning on January 1 of the first calendar year after the industrial user's application for the BMP Program is approved, unless the director approves an earlier date.

C. Compliance with Best Management Practices Program

Beginning on a date established by the director and continuing thereafter until the first compliance date for any substitute conservation requirement established in the Fourth Management Plan, an industrial user accepted for regulation under the BMP Program shall comply with all standard BMPs listed in Appendix 6B, unless the director approves a substitution of a standard BMP under subsection D of this section or a waiver of a standard BMP under subsection E of this section. If the director approves a substitution of a standard BMP, the industrial user shall comply with the substitute BMP or BMPs in addition to any remaining standard BMPs. The standard BMPs listed in Appendix 6B are broken into the following seven categories: (1) delivery of drinking water for dairy animals; (2) udder washing and milking parlor cleaning; (3) corral design and maintenance; (4) cleaning and sanitizing milking equipment; (5) dust control, calf housing cleaning, and feed apron flushing; (6) dairy animal cooling; and (7) dairy animal feed preparation.

D. Substitution of Best Management Practices

- 1. The director may allow an industrial user applying for the BMP Program to replace a standard BMP listed in Appendix 6B with a substitute BMP if the director determines that the standard BMP cannot be achieved and that implementation of the substitute BMP will result in water use efficiency equivalent to that of the standard BMP. To apply for a substitution of a standard BMP, the industrial user shall include in its application for the BMP Program an explanation of why the standard BMP is not achievable and a description of how the substitute BMP will result in water use efficiency equivalent to that of the standard BMP.*
- 2. An industrial user regulated under the BMP Program may apply to the director for a substitution of an existing BMP that is no longer appropriate for the industrial user's dairy operation. The director may allow the industrial user to replace the existing BMP with a substitute BMP if the director determines that the substitute BMP will result in water use efficiency equivalent to that of the existing BMP.*

E. Waiver of Best Management Practices

- 1. The director may waive a standard BMP listed in paragraph 3 of this subsection if the director determines that the standard BMP cannot be achieved and that no substitute BMP is appropriate. To apply for a waiver of a standard BMP listed in paragraph 3, the industrial user shall include in its application for the BMP Program an explanation of why the standard BMP is not achievable and why no substitute BMP is appropriate.*
- 2. An industrial user regulated under the BMP Program may apply to the director for a waiver of an existing BMP listed in paragraph 3 of this subsection if the BMP is no longer appropriate for the industrial user's dairy operation. The director may waive the existing BMP if the director determines that the existing BMP is no longer appropriate for the industrial user's dairy operation and that no substitute BMP is appropriate.*
- 3. Only the following standard BMPs may be waived by the director under this subsection: (1) BMP 2.1.2 (Udder Wash System); (2) BMP 2.2.2 (Milking Parlor Floor and Wall Washing); (3) BMP 4.1.1 (Milk Cooling and Vacuum Pump); (4) all of the standard BMPs in Water Use Category No. 5 (Dust Control, Calf Housing Cleaning and Feed Apron Flushing); (5) all of the standard BMPs in Water Use Category No. 6 (Dairy*

Animal Cooling); and (6) all of the standard BMPs in Water Use Category No. 7 (Dairy Animal Feed Preparation).

F. Five Year Review of Best Management Practices

Five years after an industrial user is accepted for regulation under the BMP Program, the director shall review the industrial user's BMPs to determine whether any changes in the BMPs are warranted. If the director determines that any of the existing BMPs are no longer appropriate due to an expansion of the dairy operation or a change in management practices at the operation, the director shall notify the industrial user in writing of that determination and the director and the industrial user shall make a good faith effort to stipulate to a modification of the BMPs so that they are appropriate for the expanded operation or the change in management practices.

If the director and the industrial user are unable to stipulate to a modification to the BMPs within 180 days after the director notifies the industrial user of the determination that one or more of the existing BMPs are no longer appropriate or such longer time as the director may agree to, the industrial user shall no longer be regulated under the BMP Program but shall thereafter be required to comply with the maximum annual water allotment conservation requirements set forth in section 6-802.

If the director and the industrial user stipulate to a modification of the BMPs, the industrial user shall comply with the modified BMPs by a date agreed upon by the director and the industrial user and shall continue complying with the modified BMPs until the first compliance date for any substitute conservation requirement in the Fourth Management Plan.

G. Change in Ownership of Dairy Operation

- 1. If an industrial user regulated under the BMP Program sells or conveys the dairy operation to which the BMPs apply, the new owner of the dairy operation shall continue to be regulated under the BMP Program until January 1 of the first calendar year after acquiring ownership of the dairy operation. Except as provided in paragraph 2 of this section, beginning on January 1 of the first calendar year after acquiring ownership of the dairy operation, the new owner shall comply with the maximum annual water allotment conservation requirements set forth in section 6-802. The new owner may at any time apply for regulation under the BMP Program.*
- 2. If the new owner submits a complete and correct application for regulation under the BMP Program prior to January 1 of the first calendar year after acquiring ownership of the dairy operation, the new owner shall continue to be regulated under the BMP Program until the director makes a determination on the application. If the director denies the application, the new owner shall be required to comply with the maximum annual water allotment conservation requirements set forth in section 6-802 immediately upon notification of the denial or January 1 of the first calendar year after acquiring ownership of the dairy, whichever is later. If the director approves the application, the new owner shall continue to be regulated under the BMP Program until the first compliance date for any substitute conservation requirement in the Fourth Management Plan.*

6-805. Monitoring and Reporting Requirements

For the calendar year 2002 or the calendar year in which water use is commenced at the dairy operation, whichever occurs later, and for each calendar year thereafter until the first compliance date for any substitute monitoring and reporting requirements in the Fourth Management Plan, an industrial user who uses water at a dairy operation shall include the following information in its annual report required by A.R.S. § 45-632:

- 1. The total quantity of water from any source, including effluent, withdrawn, diverted, or received during the calendar year, for use by the dairy operation as measured with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.*
- 2. The total quantity of water delivered during the calendar year to any uses other than the dairy operation from the well or wells which serve the dairy operation as measured with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.*
- 3. The total quantity of dairy wastewater delivered to grandfathered rights other than the dairy operation, as measured with a measuring device in accordance with the Department's measuring device rules, A.A.C. R-12-15-901, et seq.*
- 4. The total number of lactating cows and non-lactating animals which were present on-site at the dairy operation on the last day of each month during the calendar year.*
- 5. If the dairy operation is regulated under the BMP Program, any documentation as required by the director which demonstrates compliance with the program.*